U. S. Department of Agriculture

Forest Service

APPALACHIAN FOREST EXPERIMENT STATION

Technical Note No. 16
Pathology

Asheville, N. C.
November 4, 1935

RELATION OF CULL PERCENT TO TREE DIAMETER AND TO PERCENTAGE OF TREES WITH BASAL WOUNDS IN SOME EASTERN HARDWOODS

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The accompanying graphs are based upon the study of 5,882 trees cut in eight eastern states from New Jersey through Tennessee and west as far as Ohio. This Technical Note is the fourth 1/ of a series based on these data. In taking the basic data representative areas were chosen on commercial logging operations and data were taken on all trees cut by the operators on these areas. Logs were scaled by the Scribner log rule. The method of scaling and making deductions for defect is explained in Technical Note No. 13.

In Technical Note No. 13 the gross relation between cull and tree diameter was shown. Seventy-seven percent of the total cull volume in the trees studied was due to butt rot and 94 percent of the butt rot cull volume was in trees with basal wounds. From these figures it is apparent that a curve of cull percent based only on diameter, without considering the amount of basal wounding, would not be likely to give as dependable an estimate of cull as would a set of curves based on both diameter and percentage of trees with basal wounds. Graphs of the latter type are presented here. As the data from which these graphs were prepared were taken only on those trees cut by the operators, the graphs apply only to trees regarded as merchantable. While the criteria of merchantability varied among operators, the aggregate data might be said to represent average merchantability.

The following is a discussion of the method used in developing the graphs presented. By dividing the total volume culled because of butt rot by the total gross merchantable volume for each diameter class the butt rot cull percent for each class is obtained. These points are plotted on graph paper. Then the percentage of trees with basal wounds is recorded for each diameter class

1/ The other Technical Notes on these data are: Technical Note No. 3, "Relation Between Height of Decay and Tree Age in Certain Eastern Oaks"; Technical Note No. 13, "Relation Between Tree Diameter and Percentage of Cull in Some Eastern Hardwoods"; and Technical Note No. 14, "Relation Between Butt Rot and Fire in Some Eastern Hardwoods".

beside each of the plotted points. It is then assumed that if there has been no basal wounding there will be practically no butt rot. This assumption is justified for seedling and seedling sprout stands according to the results presented in Technical Note No. 14, which showed, for all species, only 1.5 percent cull due to butt rot in trees of merchantable size not showing basal wounds at stump height, as compared with 15.5 percent in trees showing basal wounds. As there were but few butt-rotted trees without basal wounds and the amount of rot in these trees varied considerably no attempt was made to apportion the butt rot cull in such trees over the diameter range. For the species included here this meant that a butt cull percent of 1.1 was absorbed in constructing the graphs, and it is assumed that if there has been no basal wounding there will be no butt rot. Now let us assume that white oak at 20 inches in diameter, breast high, had 5 percent cull due to butt rot and that 40 percent of the trees had basal wounds. Then if only 20 percent of the trees in that class had basal wounds, all other things being equal the butt rot cull percent would have been only 2.5, and similarly if 80 percent had basal wounds the butt rot cull percent would have been 10. In this manner points showing what the butt rot cull percent would be when 20, 40, 60, 80, and 100 percent of the trees had basal wounds were plotted for each diameter class. Straight lines were then drawn through the 20 percent basal wound points, the 40, etc. None of the point arrangements showed any marked curvilinearity. We now have 3-variable graphs showing butt rot cull percent, tree diameter, and percentage of trees with basal wounds. To get total cull percent it is then necessary to include cull from all other sources such as top rot, crook, fork, etc. In the final graph for each species, then, a curve showing the cull percent from all sources other than butt rot plotted over tree diameter is drawn first. The bottom curves in the accompanying set of graphs are such curves. The butt rot curves already computed are than drawn using this line (cull other than butt rot), rather than the zero line, as a base. The curves are then complete, and show total cull by diameter classes for different percentages of basal wounding. Cull computed from these graphs may be slightly too low for stands with a very small percentage of the trees wounded at the base, because of the absorption of the butt rot cull in unwounded trees. Therefore in the larger diameter classes, from about 24 inches breast high up, if few trees show basal wounds (up to about 25%) a figure closer to the actual cull percent will probably be obtained by adding 1 percent to the value obtained from the graph. This would correct roughly for the butt rot in trees without basal wounds.

By means of the graphs presented it should be possible to get a fair estimate of the cull percent in a given stand composed of the species studied. All the field information needed to compute the cull percent of a stand by these graphs is the number of trees and the percentage of trees with basal wounds in each diameter class, by species. In the present study 97 percent of the basal wounds were classed as caused by fire. Unfortunately from some standpoints the graphs presented are based not only on the wounds visible from the outside of the trees, but also on those healed over and not evident from the outside. It was necessary to include all basal wounds to obtain well-defined relationships of cull to wounding.

In tallying trees for application of these graphs any tree with a basal wound, no matter how small the wound may be, should be recorded as wounded. In practice, many of the healed-over wounds will probably be missed. Any tree with a hollow butt or other evidence of butt rot should be recorded as wounded though no wounds may be seen on the outside of the tree.

The graphs presented can not be expected to give reliable results for small numbers of trees. Many variables affecting the amount of decay behind wounds have not been taken into consideration in the graphs, such as age and size of wounds, size of trees at the time they were wounded, fungi causing the decay, and others. Therefore the number of trees required to give a fairly reliable estimate of cull is rather large. For estimating cull 50 trees in each diameter class, of a given species, are suggested as a minimum. Estimates based on these graphs would be low for trees with all old fire scars and high for trees burned just a few years before tallying.

For some purposes it may be desirable to combine certain species into species groups. In such cases the cull graphs for those species might be combined or else one graph that is fairly close to the average for the species being grouped may be used for the group.

The data upon which the accompanying graphs are based were taken in stands mainly of seedling and seedling sprout origin, and the conclusions apply only to such stands. In the sprout stands that develop as the result of repeated cutting on short rotation, butt rot often occurs independently of basal wounds. In such sprout stands decay often progresses to the new sprout from the parent stump.

These graphs are not intended to take the place of detailed local cull studies. They are to serve more as a guide to how much cull may be expected in various stands, and to provide a quick means of approximating the cull percent of a given stand.

RELATION OF CULL PERCENT TO TREE DIAMETER AND PERCENTAGE OF TREES WITH BASAL WOUNDS
(Based only on trees regarded as merchantable when cut)